

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Solar System Exploration including Ocean Worlds (5)

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EXPLORATORY MISSION TO MERCURY: POSSIBILITIES FOR FUTURE SAMPLE RETURN
MISSIONS**Abstract**

The planet Mercury is named after the messenger of Roman gods, because even the ancients could see how swift and fleeting it is in the sky. Early risers may mistake Mercury for a star in the morning twilight and it wasn't until recently that scientists began unravelling Mercury's many mysteries. The planet Mercury, being so close to the Sun, is a difficult object for study by astronomical means and poses challenges for spacecraft exploration as well. This paper takes a futuristic case study of an interplanetary mission to Mercury, which is approximately 1.04 AU away from us. In terms of solar distances, it is not much but, being the closest to the Sun, it becomes a difficult object for study by astronomical means and poses challenges even for spacecraft exploration. Two spacecrafts have already visited the innermost planet and revealed quite compelling details of it. Despite being the planet closest to the Sun and with surface temperature reaching as high as 430 degree Celsius, Mercury has water ice trapped in the depth of craters at its north pole. Mercury's core makes up 85 percent of the planet's volume - much more than Earth's, which makes up just 15 percent. Several studies have shown the presence of water ice on the Moon and Mars however, taking the planet closest to the Sun will help test our engineering and astrodynamics knowledge as it actually takes more energy for a spacecraft to reach Mercury than Pluto. This paper will take a futuristic case study of an exploratory mission and various possibilities of space travel will be discussed in detail. Comprehensive tables and graphs will be given, which will depict the amount of time that will pass at each mode of travel and more importantly some idea on the cost in terms of energy as well as money will be discussed within today's context. In addition, prerequisites to such an interplanetary mission to Mercury and a possibility for a sample return mission from it will be given in detail. Even though the possibility of such a mission is probably non-existent for this decade, it is essential to do these exercises so that mankind's understanding of the planet will be increased. Mercury possesses a handful of mysteries that need to be solved for our increased understanding of planets in our inner solar system and exercises like these would serve as a means to add to the understanding of early solar system formation.